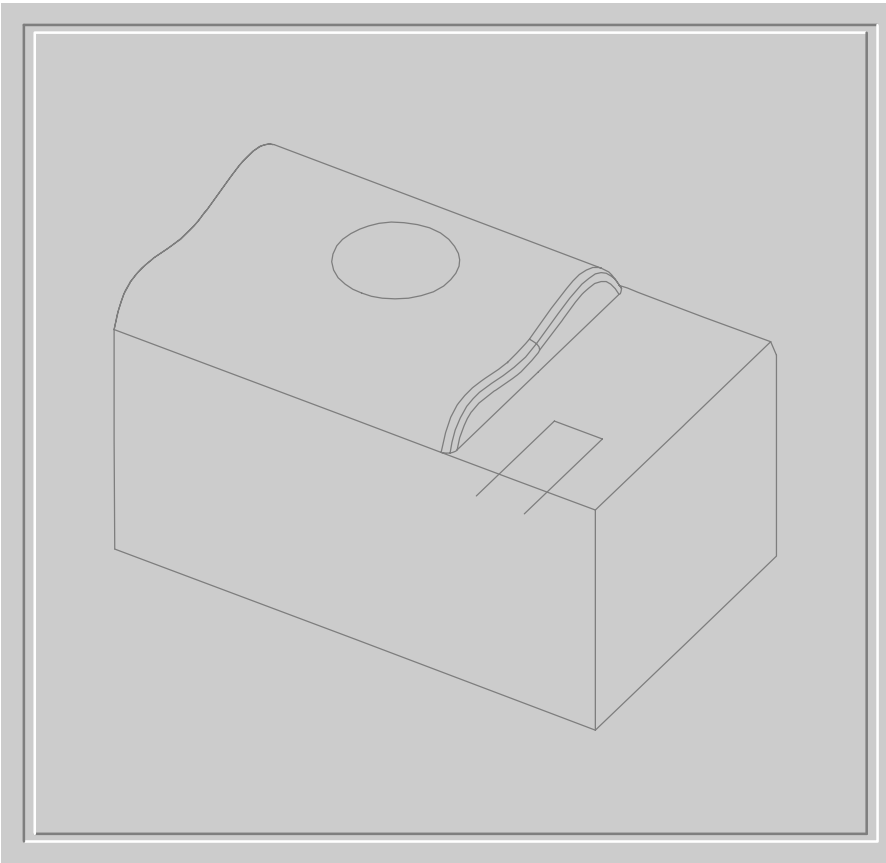


# Creating Manual Milling Operations

**I-DEAS® Tutorials: Milling Projects**

A manual operation is a 3-axis milling operation that drives along a section to create a toolpath. You can use manual operations for lettering, slotting, and non-standard moves that you can't do with other operations.

In this tutorial, you'll learn how to create projected and non-projected manual operations. You'll also learn how to define axial depths and side passes from a section.

## Learn how to:

- create a projected toolpath
- create multi pass by pass toolpath
- create multi pass array toolpath

# Before you begin...

## Prerequisite tutorials:

- all tutorials under the Modeling Fundamentals menu
- Introduction to Generative Machining
- Building a Setup Assembly
- Generating In-process Stock and Checking Validity
- Working with Tools and Tool Catalogs
- Picking Holes
- Setting Machining Parameters for Hole-making Operations

The file you need for this tutorial is distributed with the product. You must copy it into your local directory.

Move to the local directory where you want to copy the file. Then:

In UNIX:

cp $SDRC_INSTL/examples/nc/ tut_manual.arc .

In Windows:

copy %SDRC_INSTL%\examples\nc\ tut_manual.arc .

If you can't copy the file, you may have to set up the variable needed to copy from the I–DEAS installation.

. sdrc_oadev

If you can't access the file, contact your system administrator. The file may not be installed.

If you didn't start I-DEAS with a new (empty) model file, open a new one now and give it a unique name.

*File*
*Open*

---

*Model File Name:* any unique name
*OK*

---

Make sure you're in the following application and task:

*Application: Manufacturing*
*Task: Generative Machining*

Set your units to inches.

*Options*
*Units*


*Inch (pound f)*

Import the archive file that contains the parts and tools that you need to complete this tutorial. Importing an archive file can take several minutes. Be patient.

*File*
*Import*

### Import Selections form


*I–DEAS Archive File*

*OK*

### File Name Input form

*Archive file name:* tut_manual.arc

*OK*

The Manufacturing application quits, an informational message is displayed (the message will dismiss automatically), and the archive file is imported.

### Import Archive File Status


**Check *I-DEAS List***.

Be sure to check the List region to be sure that the parts imported properly.

*Dismiss*

A second informational message is displayed (the message will dismiss automatically) and the Manufacturing application starts.

### Confirm SAVE

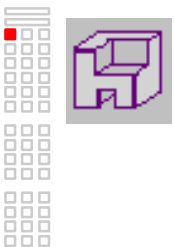
*No*

---

If you've toggled on *Automatically save after Library and Catalog operations* in *Options*, *Preferences*, *Data Management*, the software will save your model file after you copy the parts.

---

Create a job.



---

### NC Job Create form

*Job Name:* Manual Milling

*OK*

---

Add the part to the job.

*Get*

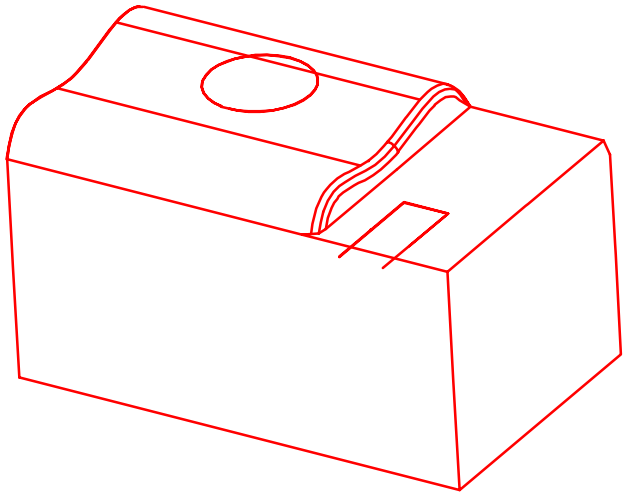
*From Bin/Library*

---

### Select Part/Assembly form

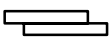
tut_manual

*OK*



The part is located relative to the global-space coordinate system with the origin at the center of the workplane. You can view the global-space coordinate system by picking *Workplane Appearance...*, then toggling on *Display Origin* on the *Workplane Attributes* form.

## Recovery Point



*File*
*Save*

## Warning!

If you are prompted by I-DEAS to save your model file, respond:

*No*

Save only when the tutorial instructions tell you to—not when I-DEAS prompts for a save.

If you make a mistake at any time between saves and can't recover, you can reopen your model file to the last save and start over from that point.

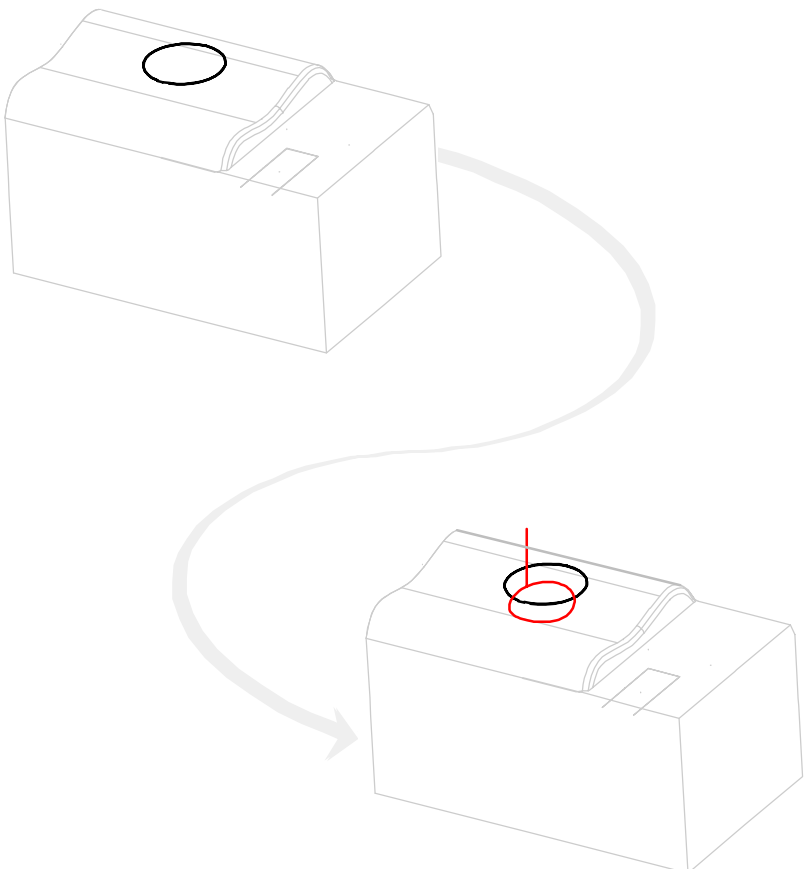
## Hint

To reopen your model file to the previous save, press Control-Z.

# Create a projected toolpath 1 of 7

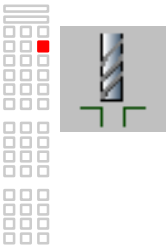
In the next steps, you'll generate a projected toolpath for a manual operation. To create a projected manual operation, you sketch a section above or below the desired surface. For this tutorial, the sections have been created for you.

After you pick the section for the operation, the tool drives along the section while staying in contact with the surface. Generally, you create projected toolpaths on complex or non-planar surfaces.



**What:** Create a manual operation.

**How:**



---

### Operation Selection form

- *Category*: *Milling*
- *Type*: *Manual*
- *Create*

---

Don’t close the Operation Specification form.

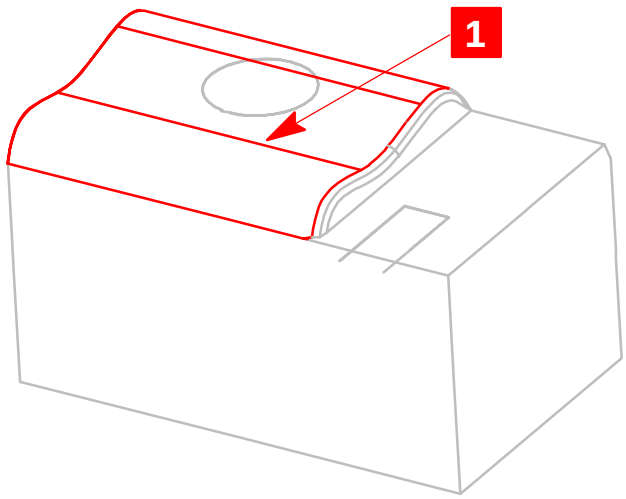
**What:** Name the operation and pick the surface to be machined.

**How:**

### Operation Specification form

*Name*: Manual Projected

F18




*Dismiss*

Don’t close the Operation Specification form.

**What:** Get a 1/2” ball mill from the tool catalog.

**How:** You’ll open the project supplied with the software for this example.

### Operation Specification form

### Cutting Tool Specification – Mill form

 *Find*

### Item Selection form

 1/2” dia ball mill

 *OK*

 *OK*

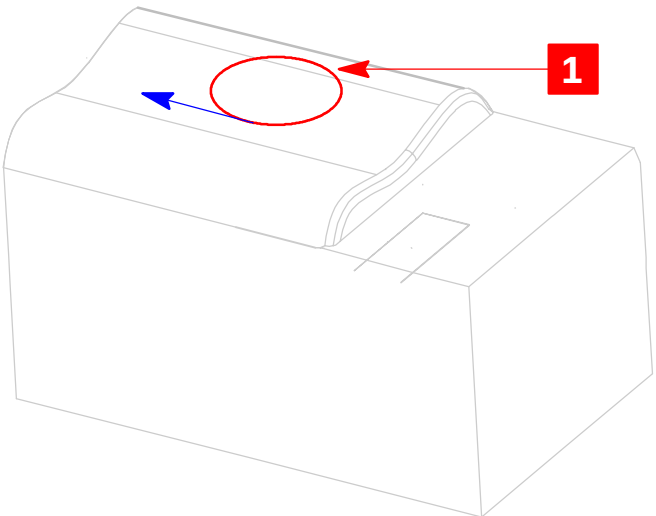
 Don’t close the Operation Specification form.

**What:** Pick the section to define the path for the tool. Notice that the section is not located on the surface but is positioned above it.

**How:**

### Operation Specification form

### Machining Parameters form




**Things to notice**

An arrow appears on the section to indicate the proposed direction of the cut. Also, note that the section is positioned above the part.

### Guide Curve Sets form

 *OK*

Don’t close the Machining Parameters form.

**What:** Set the *Offset Side* so the tool cuts inside the section. Then enter −.25 inches in *Z Translation* so the tool cuts at this depth into the part.

**How:**

---

### Machining Parameters form

*Project onto:* Surface

*Offset Side*

*Single Pass with Z Translation of*: −0.25

*Cut...*

*Entry...*

---

*Entry Type*: *Plunge*

*Entry...*

*Exit...*

---

*Exit Type*: *Lift*

*OK*

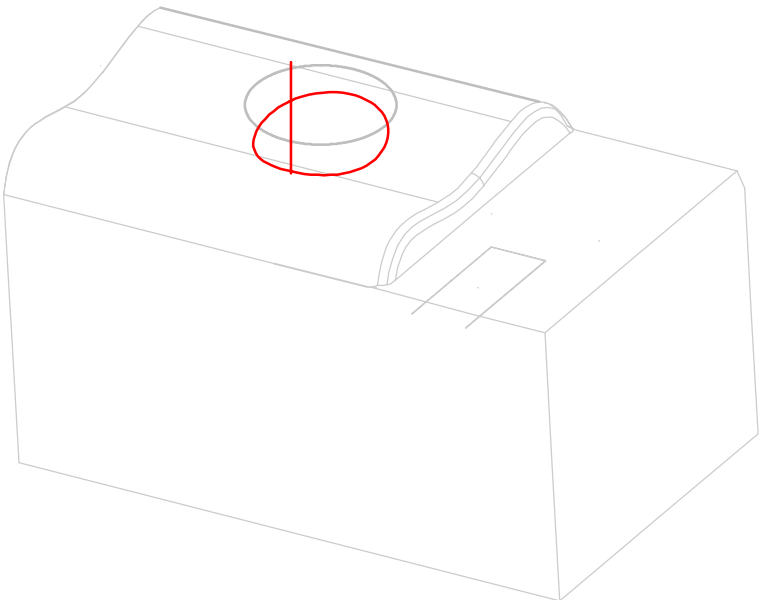
---

Don’t close the Operation Specification form.

**What:** Generate the toolpath.

**How:**

### Operation Specification form



## Things to notice

The toolpath is projected from the section onto the surface. The tool cuts within the section and is translated .25 inches into the part.

## Recovery Point

*File*
*Save*

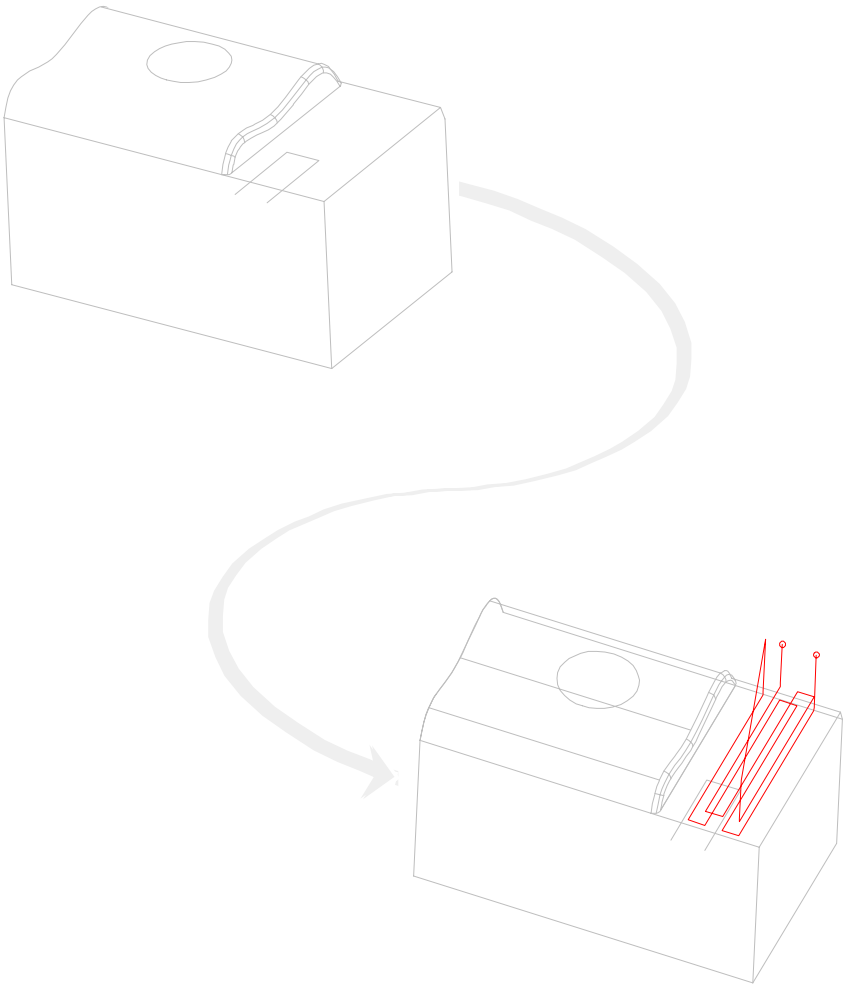
Don’t close the Machining Parameters form.

# Create a multi pass by pass toolpath 1 of 7

Unlike a projected operation, a non–projected operation cuts directly on a curve set and the toolpath isn't projected onto a surface. Multiple depth passes and side passes can be cut from the curve set location.

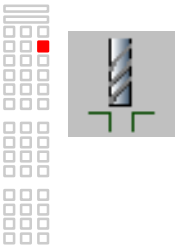
You can use non–projected operations to cut features that haven't been modeled onto your part.

Using a multi pass by pass non–projected operation, you can fully control when and where each depth pass and side pass occurs.



**What:** Create a manual operation.

**How:**



### Operation Selection form

*Category*: *Milling*

*Type*: *Manual*

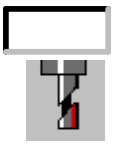
*Create*

Don’t close the Operation Specification form.

**What:** Get a 2” diameter end mill from the tool catalog.

**How:**

### Operation Specification form



*Name*: L–face machining

### Cutting Tool Specification – Mill form

*Find ...*

### Item Selection form

*2” dia end mill*

*OK*

### Cutting Tool Specification – Mill form

*OK*

Don’t close the Operation Specification form.

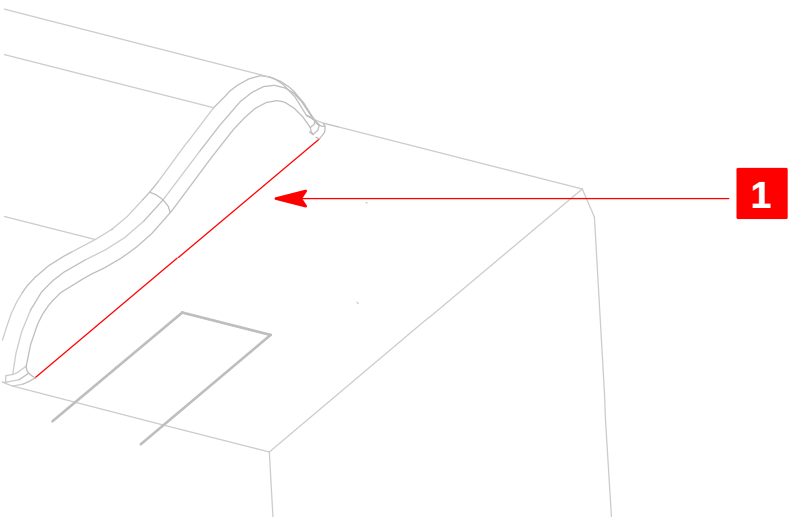
**What:** Create a curve set to define the path for the tool. Notice that you didn't pick a surface for this operation. You don't have to pick a surface for a non−projected operation.

**How:**

### Operation Specification form

### Machining Parameters: Cut form

**1** *E32*




### Guide Curve Sets form

 *OK*

Don't close the Machining Parameters: Cut form.

**What:** Toggle off *Project onto* to define this operation as non-projected. Then define a multi pass by pass set of depth passes and side passes to rough machine the L–face feature.

**How:**

 *Offset Side*

- *Project onto*—Off
- *Multi Pass by Pass*—On
- *Connect Bi–Directional Passes*—On
- *Define Passes....*

**Define Passes form**

- *Climb*
- *Keyin Depth*: 0.5 (in the field under the table)
- *Keyin XYOffset*: 0.5 (in the field under the table)

- *Conventional*
- *Keyin Depth*: 0.5
- *Keyin XYOffset*: 1.0

- *Climb*
- *Keyin Depth*: 0.5
- *Keyin XYOffset*: 1.5

Don’t close the Define Passes form.

**What:** Add pass by pass definitions to finish machine the L–face feature in the same operation.

**How:**

 *Climb*

 *Keyin Depth*: 0.0

 *Keyin XYOffset*: 0.0

This pass has no offsets, so it finish machines the wall and the first pass along the floor.

Continue to create the following passes, in the following order:

- Conventional
  Keyin Depth: 0.0
  Keyin XYOffset: 0.5

- Climb
  Keyin Depth: 0.0
  Keyin XYOffset: 1.0

- Conventional
  Keyin Depth: 0.0
  Keyin XYOffset: 1.5

 *OK*

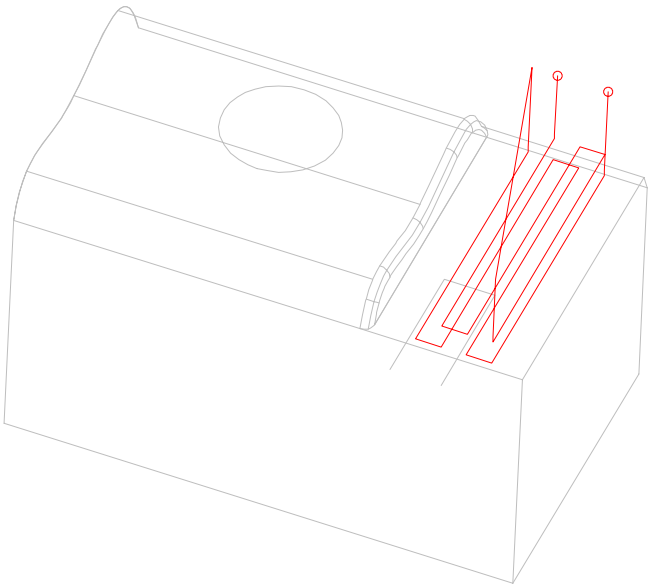
 *OK*

 Don’t close the Operation Specification form.

**What:** Generate the toolpath.

**How:**

### Operation Specification form



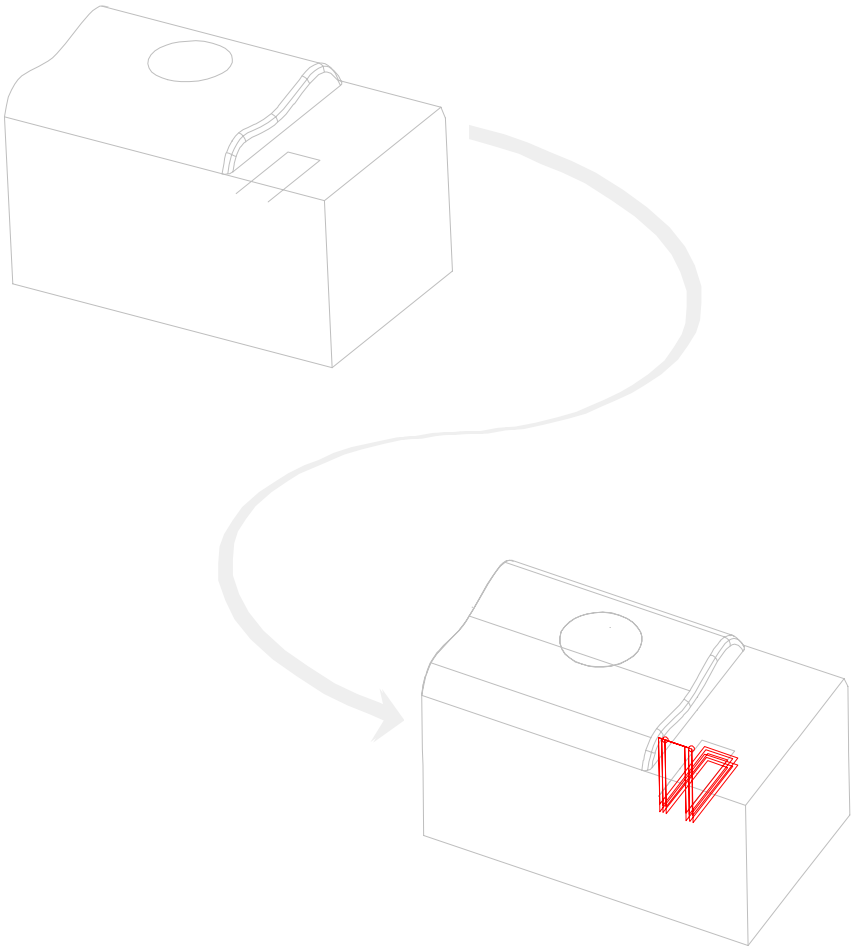
**Optional**
If necessary, rotate the part to view the different pass depths and offsets.

**Recovery Point**

*File*
*Save*

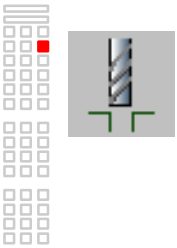
You can also specify both depth passes and side passes using a multi pass array operation. All of one pass type is machined before the other pass type is started.

In the next steps, you'll create a non–projected toolpath using a multi pass array. You'll pick a section that represents a slot on the front surface. Then, you'll generate multiple axial depths and side passes from the section.



**What:** Create another manual operation.

**How:**



---

### Operation Selection form


*Category*: *Milling*


*Type*: *Manual*


*Create*

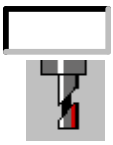
---

Don’t close the Operation Specification form.

**What:** Get a 1/4” end mill from the tool catalog.

**How:**

### Operation Specification form



*Name*: Non−projected slot

### Cutting Tool Specification – Mill form

*Find...*

### Item Selection form

1/4” dia end mill

*OK*

### Cutting Tool Specification—Mill form

*OK*

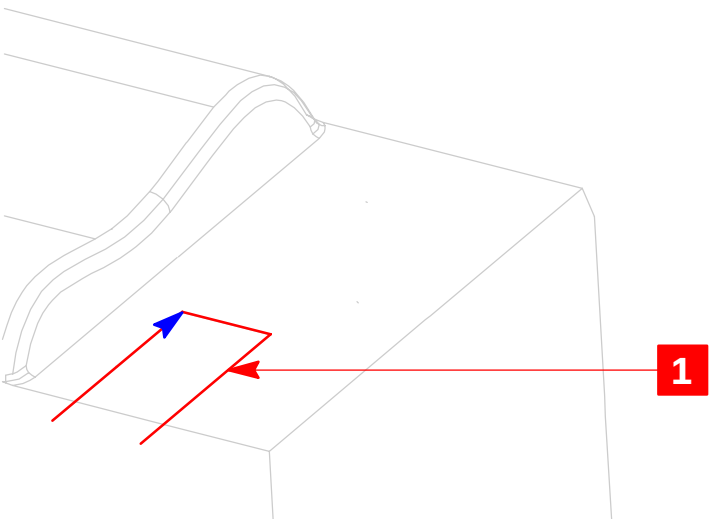
Don’t close the Operation Specification form.

**What:** Pick the section to define the path for the tool.

**How:**

### Operation Specification form

### Machining Parameters: Cut form




### Guide Curve Sets form

 *OK*

Don’t close the Machining Parameters: Cut form.

**What:** Add two axial depths to cut a .5 inch deep slot into the part.

**How:**

 *Offset Side*

 *Multi Pass Array*—On

 *Axial Depths...*

---

**Axial Depths form**

 *Depths Measured From:* Curve Set

 *To:* Tool Tip

 –.25 (in the field under the table)

 –.5 (in the field under the table)

 *OK*

---

 Don’t close the Machining Parameters: Cut form.

**What:** Add two side passes. The software automatically machines a pass along the section. You add two side passes to clean out the slot completely.

**How:** Enter two side passes in the first field. Then enter a stepover of .1 in the second field.

### Machining Parameters: Cut form

*Side Passes...*

### Side Passes form

Passes: 2 (first field)

Keyin Stepover: .1 (second field)

### Things to notice

The table displays three columns:

- the number of side passes: 2
- the stepover: .10000
- the total distance between the side pass and the section: .20000

*OK*

### Machining Parameters: Cut form

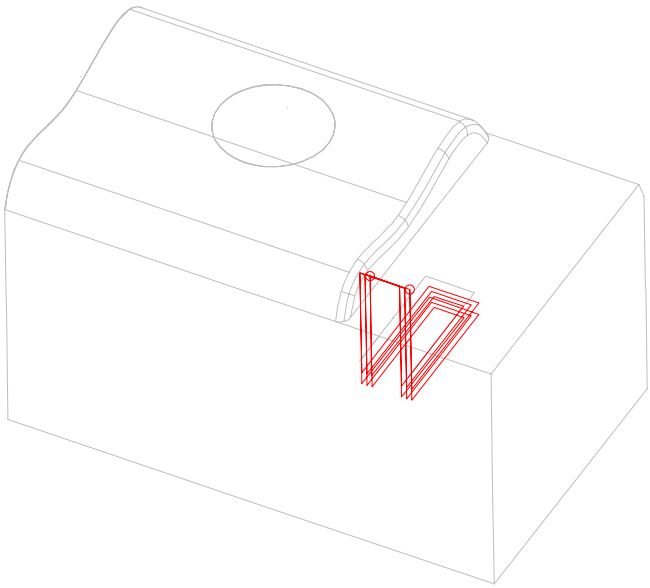
*OK*

Don’t close the Operation Specification form.

**What:** Generate the toolpath.

**How:**

### Operation Specification form



## Things to notice

The toolpath contains two axial depths and three side passes—the one the software automatically created plus the two you added. Also, notice how the section was sketched past the edge of the part so the cutting motion would begin before contacting the surface.

## Recovery Point

*File*
*Save*

# Tutorial wrap-up

You’ve completed the Creating Manual Milling Operations tutorial.